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| EXAMINER | |
|---|---|
| WANG, EUGENIA | |
| **ART UNIT** | **PAPER NUMBER** |
| 1745 | |

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

|  |  |  |  |
|---|---|---|---|
| ***Office Action Summary*** | **Application No.**<br>10/685,346 | **Applicant(s)**<br>MATHIAS ET AL. |  |
|  | **Examiner**<br>Eugenia Wang | **Art Unit**<br>1745 |  |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --***

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *2-8,10-31,35-40,43,44 and 48-57* is/are pending in the application.

4a) Of the above claim(s) *9,41,45 and 47* is/are withdrawn from consideration.

5)☒ Claim(s) *54* is/are allowed.

6)☒ Claim(s) *2-8,10-13,17,20-31,35,36,38-40, 43, 44, 48-53, 55-57* is/are rejected.

7)☒ Claim(s) *14-16, 18, 19, 37* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 January 2007* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Response to Amendment*

1. In Response to the amendment received January 3, 2007:

a. Claims 9, 41, 45, and 47 have been cancelled as per Applicant's request. Claims 2-8, 10-31, 35-40, 43, 44, and 48-57 are pending.

b. The previous objection to the specification is withdrawn in light of the amendments.

c. The new drawings submitted January 3, 2007 are acknowledged. The previous objections to the drawings are withdrawn in light of the new drawings.

d. The previous claim objections have been withdrawn in light of the amendments.

e. The previous 112 rejections, except for issue regarding contact angles (claims 20-23), have been withdrawn in the light of the amendment;

f. The previous prior art rejections of record have been withdrawn. A new grounds of rejection has been made herein, not fully necessitated by amendment. Thus this office action is non-final.

### *Claim Objections*

2. Claim 48 is objected to because of the following informalities: it is dependent on cancelled claim 47. Appropriate correction is required. Claim 48 is interpreted as being dependent on independent claim 57 for the remainder of this action, since cancelled claim 47 was dependent on independent claim 57.

## *Claim Rejections - 35 USC § 112*

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 19, 20-23, 43, 44, 48-53, and 57 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a. Claim 19 refers to "characteristic density value," which is unclear and thus indefinite (line 2).

b. Claim 20 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The usage of "about 180°" (line 3) of the claim is indefinite, as "about" is indicative that the contact angle can be larger than 180°.

c. Claims 20-23 use the terms "advancing contact angle" (claims 20 and 21) and "receding contact angle" (claims 22 and 23) are not defined or differentiated in a clear manner and thus are indefinite.

Where applicant acts as his or her own lexicographer to specifically define a term of a claim contrary to its ordinary meaning, the written description must clearly redefine the claim term and set forth the uncommon definition so as to put one reasonably skilled in the art on notice that the applicant intended to so redefine that claim term. *Process Control Corp. v. HydReclaim Corp.*, 190 F.3d 1350, 1357, 52 USPQ2d 1029, 1033 (Fed. Cir. 1999). The term "contact angle" in claims 20-23 is used by the claim to mean "the exterior angle between the liquid and the solid", while the accepted meaning is "interior angle between the liquid and the solid." This is evidenced by "Contact angle from Wikipedia" and U.S. Patent 6350539 (Wood, III et al.). The term is indefinite because the specification does not clearly redefine the term.

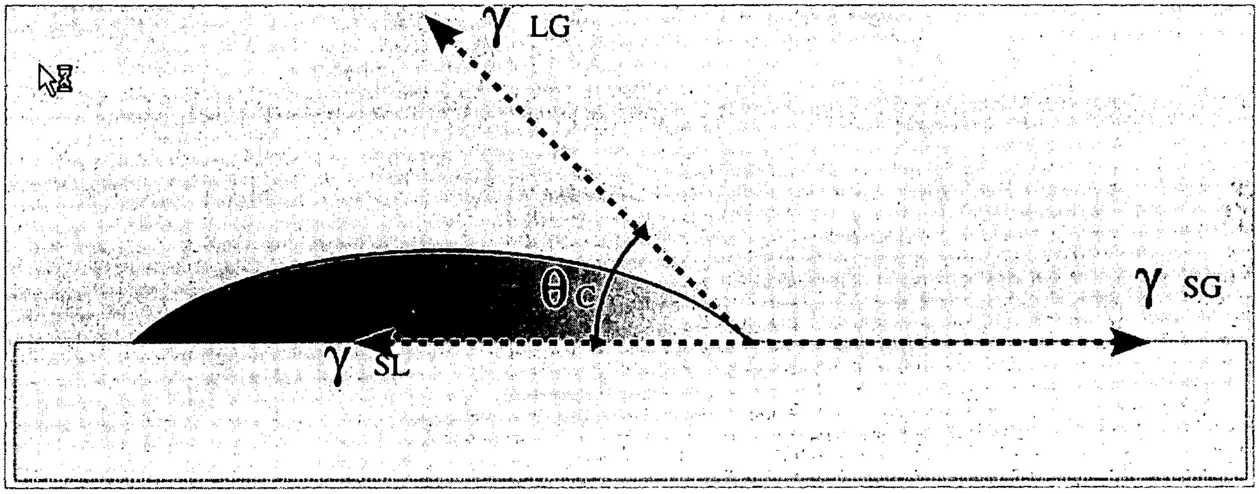
d. Claim 57 recites the limitation "said distribution of water transfer particles" in line 5. There is insufficient antecedent basis for this limitation in the claim. Since claims 43, 44, and 48-53 are dependent on claim 57 and fail to rectify the issue, they are rejected as well.

### ***Response to Arguments***

5. Applicant's arguments filed January 3, 2007 have been fully considered but they are not persuasive.

As to claims 20-23, applicant argues that hydrophobic contact angles have been clearly defined as being between about 135° and about 180° along either major surface [21, 23] and that receding contact angles, defining hydrophilicity, have been clearly defined as between being between about 95° and about 135°.

Examiner respectfully disagrees with Applicant, as the ordinary meaning of contact angles seem to be the opposite as what Applicant has defined. Wood, III et al. defines hydrophobicity as having a contact angle greater than 90° and hydrophilicity as having a contact angle less than 90°, wherein the contact angle is the angle between any tangent of the droplet of liquid formed and the solid surface (col. 7, lines 42-48). This definition is reinforced by the definition provided by "Contact angle from Wikipedia," as the source defines hydrophilic surfaces having small contact angles (10° to 30°) and hydrophobic surfaces having large contact angles (70° to 90°, even as high as 150° or even 180°) ('Typical contact angles', lines 2-5). The figure below (taken from "Contact angle from Wikipedia" illustrates the point: ($\theta_c$ is the contact angle.)



*Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 2-6, 8, 10, 11, 17, 24, 25, and 55 are rejected under 35 U.S.C. 102(b) as being anticipated by US 6024848 (Dufner et al.).

Upon further consideration the teachings of Dufner are in fact, held to anticipate the aforementioned claims for the following reasons:

7. As to claim 55, Dufner et al. teaches bi-layer, porous support plates [40,42] (col.3, lines 53-55). The purpose of the plates is to enhance the transport of fluids

throughout the cell (col. 4, lines 21-22). Fig. 2 shows the plates, which clearly define a major planar dimension, with two major faces running parallel to the planar dimension ([44, 48] and [46, 50]). In one bi-layer (contact layer [34, 44]) of Dufner et al.'s support plate is a mixture of hydrophobic and hydrophilic materials, which creates integrated but discrete regions (col. 8, lines 2-8). The other layer (substrate layer [46, 50]) is made of a plurality of hydrophobic [54 A-E, 58 A-E] and hydrophilic [52 A-E 56 A-E] sections, which is shown to alternate across the major planar dimension of the porous plate. It is important to note the connection between hydrophilicity and density of water transfer particles. Dufner et al. teaches that the hydrophilic phase facilitates transfer of liquid (col. 4, lines 8-13). Therefore, a high density of water transfer particles corresponds to a hydrophilic nature, while a low density of water transfer particles corresponds to a hydrophobic nature. Additionally, Dufner et al. discusses dispersing polyflourosulfonic ionomer into a carbon black can be used for hydrophilic material (col. 9, lines 28-39). As previously mentioned, Dufner et al. discloses that the contact bi-layers [44, 48], which are placed on a face of the porous diffusion media, comprise of between 50% to 80% of the hydrophobic phase and between 50% to 20% of the hydrophilic phase (col. 7, lines 48-51).

The teachings of Dufner et al. have been previously discussed are herein incorporated.

Regarding claim 2-8 and 25, the teachings of Dufner et al. are set forth above. Dufner et al. further discusses the use of porous carbon-carbon fibrous composite for substrate layers [46, 50] (as applied to claim 25) (col. 7, lines 54-56). As previously mentioned Dufner et al. discusses dispersing polyflourosulfonic ionomer into a carbon black can be used for hydrophilic material, making the ionomer and carbon black the water transfer particles (as applied to claims 2, 3, 5, 7, and 25) (col. 9, lines 28-39). Since an ionomers are plastics, and thus polymers, the mixture is a carbon/polymer composite (as applied to claim 4). Carbon black, described as including graphitized carbon black, is used in the hydrophilic material (as applied to claim 5) (col. 6, lines 37-42). Dufner et al. also teaches wettability improvement of the discrete hydrophilic region if it is treated with certain compounds; the list given - aluminum oxide, silicon oxide, and tin oxide – are all metal oxides (as applied to claims 2 and 3) (col. 8, lines 28-34). Dufner et al.'s invention further teaches plates that include hydrophilic areas, which appear in a mixed form [44, 48] or in discrete form [46, 50], where each hydrophilic area is forms the porous matrix it comprises of (as applied to claim 6) (col. 6, lines 24-32; column 7, lines 54-55). As the substrate layers [46, 50] are a porous, fibrous, carbon-carbon composite layer, it inherently can be described as a carbon paper (as applied to claim 7) (col. 7, lines 54-56). Additionally, carbon black is used in the hydrophobic regions of the porous support plates (col. 6, lines 35-36) (as to claim 8).

Regarding claims 10, 11, 13, 17, 24 Dufner et al.'s support plates show sections where the hydrophilic sections are distributed across a cross section of the porous diffusion media between the first and second major faces of the diffusion area, as is seen in the bi-layers denoted by [46, 50] (as applied to claim 10). Furthermore, Dufner et al.'s porous support plate have high and low particle density regions that alternate across both first and second major faces of said diffusion media, as show in the fig. 2 by substrate [46, 50], which are shown by alternating hydrophobic and hydrophilic regions [54 A-E, 58 A-E] and [52 A-E, 56 A-E], respectively (as applied to claims 11 and 13). Additionally, the porous high density particle region is inherently substantially uniform from one high particle density region to the next across one of said first and second major faces of said diffusion media, as the material used to make the high-particle density regions are the same (as applied to claim 17). Additionally, the substrate layers [46, 50] are said to be made of a porous carbon-carbon fibrous composite having approximately sixty-five to seventy-five percent porosity, making the porosity profile substantially uniform across the substrate (as applied to claims 17 and 24) (col. 7, lines 54-56).

As to claims 38, 39, Dufner et al. teaches that in the contact bi-layers [44, 48], the comprise of a hydrophilic phase that includes a mixture of carbon black and a hydrophobic polymer, where one example of the hydrophobic polymer is a fluorinated ethylene propylene (col. 6, lines 51-55; col. 7, lines 6-8).

As to claim 56, the water transfer particles inherently have to have dimensions small enough to migrate through the dimensions of the porous matrix, since the particles are small enough to fit into the porous matrix.

## ***Response to Arguments***

8. Applicant's arguments filed January 3, 2007 have been fully considered but they are not persuasive.

As to claim 55, Applicant argues that none of the references teach high and low density regions used to produce hydrophilic and hydrophobic regions and that adjusting the density of water transfer particles to do so would be impermissible hindsight.

Examiner respectfully disagrees with the fact that Dufner et al. does not teach high and low density regions. Additionally, the rejection to claim 55 does not mention the alteration of density of water particles in order to achieve varied hydrophilic and hydrophobic regions. The substrate layer [46, 50] of Dufner et al.'s invention is made of a plurality of hydrophobic [54 A-E, 58 A-E] and hydrophilic [52 A-E 56 A-E] sections, which is shown to alternate across the major planar dimension of the porous plate, where the hydrophilic sections are inherently drawn to having a high density of water transfer particles.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

As to claim 55, Applicant additionally argues that Dufner et al. fails to teach hydrophobic materials used in a layer in their apparatus.

Examiner respectfully disagrees with that Dufner et al. does not teach a layer comprising hydrophobic materials used in their apparatus. Dufner et al. discloses that the contact bi-layers [44, 48], which are placed on a face of the porous diffusion media, comprise of both hydrophobic and hydrophilic materials (col. 7, lines 48-51).

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 12, 28, 29, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dufner et al..

The teachings of Dufner et al. have been previously discussed and are herein incorporated.

As to claim 12, Dufner et al. does not teach that the period of alternating density regions is less than about 1 cm. However, the period of the alternating density regions is a result effective variable. Having larger periods would more easily facilitate water transfer with respect to the period, while having smaller periods would provide a more evenly distributed transfer of both gas reactants and the liquid product. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have made an alternating period less than about 1 cm, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch,* 617 F.2d 272, 205 USPQ 215 (CCPA 1980). It has been held that discovering that general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233. Generally, differences in ranges will not support the patentability of subject matter encompassed by the prior art *unless* there is evidence indicating such ranges is critical. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969).

As to claims 28 and 29, Dufner et al. does not teach a porous matrix defined by a permeometer number, more specifically a Gurley permeometer number - 50 $ft^3/min/ft^2$ at about 0.5 inches of water and between 20 $ft^3/min/ft^2$ to 100 $ft^3/min/ft^2$ at about 0.5 inches of water, respectively. Permeometer numbers, however, characterize porosity by measuring the time it takes for a certain volume of air to flow through a cross section (area) of a sample at a certain pressure. Because porosity provides both surface area contact as well as spaces for facile flow throughout the matrix, porosity can be labeled a result effective variable. It can be optimized with respect to fluid transfer performance. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have optimized the permeometer number of the porous matrix, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch,* 617 F.2d 272, 205 USPQ 215 (CCPA 1980). It has been held that discovering that general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,*105 USPQ 233. Generally, differences in ranges will not support the patentability of subject matter encompassed by the prior art *unless* there is evidence indicating such ranges is critical. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969).

Regarding claim 36, the loading of hydrophobic material at 5 mg per $cm^2$ on the diffusion surface is not specified. However, the loading is a result effective variable, as its dispersion within the diffusion matrix affects porosity at that surface. Porosity is a balance between surface area contact as well as spaces for facile flow throughout a porous matrix. Thus, porosity can be optimized with respect to performance of the matrix (ie fluid transfer). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have optimized loading of the hydrophobic material at the surface of the diffusion media, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch,* 617 F.2d 272, 205 USPQ 215 (CCPA 1980). It has been held that discovering that general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,*105 USPQ 233. Generally, differences in ranges will not support the patentability of subject matter encompassed by the prior art *unless* there is evidence indicating such ranges is critical. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969).

10. Claims 20-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dufner et al. in view of Wood, III et al.

The teachings of Dufner et al. have been previously discussed and are herein incorporated.

As to claims 20-23, Dufner et al. do not mention contact angles with respect to hydrophilicity (about 135° to 180°, 160° to 168°, 95° to 135°, and 95° to 105° as applied to claims 20 to 23, respectively. As previously mentioned, "Contact angle from Wikipedia" as well as Wood, III et al. define the contact angle as the interior angle between the liquid droplet and the solid interface. Moreover, Wood, III et al. define hydrophilic materials to have a contact of less than 90° (column 7, lines 47-48).

However, Wood, III et al. further denotes that hydrphobicity more specifically contact angle between 70° and 110° and hydrophilicity is at an angle less than 70°. Since the claim language uses contact angle differently, the numbers that are needed for comparison purposes are: (180°- angle). The redefinition of contact angle in terms of the given claim now means that hydrophilic materials have a contact angle of more than 90°, namely more than 110°. However, overlapping ranges are *prima facie* evidence of obviousness. It would have been obvious to one having ordinary skill in the art to have selected the portion of Wood, III et al.'s range corresponding to the claimed ranges. *In re Malagari*, 182 USPQ 549 (CCPA 1974). Generally, differences in ranges will not support the patentability of subject matter encompassed by the prior art *unless* there is evidence indicating such ranges is critical. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969).

As to claims 26, 27, and 35, Dufner et al. does not teach a specific thickness of the porous matrix - between 20 μm and 1000 μm with respect to claim 26, especially about 200 μm with respect to claim 27. Furthermore the thickness of the hydrophobic layer (up to about 125 μm, as claimed by claim 35) is not taught. Wood, III et al. teaches a three layer diffusion structure that has a thickness range between 160 μm and 1300 μm for its uncompressed, preassembled state (column 7, lines 65-67; column 8, lines 1-2). Moreover, the desorpbtion (hydrophobic) layer (column 7, lines 39-40). is given a thickness range for the uncompressed material: 40 μm to 400 μm (column 8, lines 1-2). It would have been obvious to make the diffusion layer and the hydrophilic layer with the thicknesses specified by the claims, as the ranges (with respect to claims 26 and 35) overlap somewhat and that the specified value in claim 27 falls within the range in claim 26. It has been held that when the difference between a claimed invention and the prior art is the range or value of a particular variable, then a prima facie rejection is properly established when the difference in the range or value is minor. Titanium Metals Corp. of Am. v. Banner, 778 F.2d 775, 783, 227 USPQ 773, 779 (Fed. Cir. 1985). Generally, differences in ranges will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such ranges is critical. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). In re Hoeschele, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969). Claims that differ from the prior art only by slightly different (non-overlapping) ranges are prima facie obvious without a showing that the claimed range achieves unexpected results relative to the prior art. (In re Woodruff, 16 USPQ2d 1935,1937 (Fed. Cir. 1990))

11. Claims 30, 31, and 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dufner et al. in view of EP 0872/907 (Taniguchi et al.).

The teachings of Dufner et al. have been previously discussed and are herein incorporated.

As to claims 30 and 31, Dufner et al. do not teach agents used for binding water transfer particles. However Taniguchi et al. teaches bulking materials, where a hydrophilic bulking phase (R2) is used to bind the hydrophilic phase (R1) to the porous substrate (column 7, lines 29-32). Examples of the binders given are polymeric flouroresins: polytetrafluoroethylene (Teflon, PTFE), tetrafluoroethylene-perfluoroalkylvinylethercopolymer (PFA), tetrafluoroethylene-hexafluoropropylenecopoplymer (FEP), polychlorotrifluoroethylene (PCTFE), polyvinylidene fluoride (PVDF), polyvinyl fluoride (PV), and tetrafluoroethylene-ethylenecopolymer (ETFE) (column 7, lines 19-32). The motivation for wanting to bind the water transfer particles is to keep them from moving and thus inhibiting them from keeping water away from the interface between the electrode and current collector and keeping the electrolyte membrane humidified. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to bind the water transfer particles in order keep them in their place in order to serve the purpose of helping keep water away from the interface between the electrode and current collector and keep the electrolyte membrane humidified

As to claim 40, Dufner et al. do not teach of a hydrophobic material comprising of a polymer selected from polyphenylene or polyvinylidene fluoride (PVDF). However, Taniguchi et al. teach that polyvinylidene fluoride (PVDF) is usable as a hydrophobic material (col. 7, lines 19-21 and 27). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use PVDF as the hydrophobic polymer in the hydrophobic material, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin,* 125 USPQ 416.

### *Allowable Subject Matter*

12. Claims 14-16, 18, 19, and 37 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Claim 14 teaches a porous diffusion media with a cross-sectional dimension of high and low particle density regions that vary inversely between the first and second major faces of the diffusion media.

Dufner et al. does teach, suggest, or render obvious the using of inversely varying high and low particle density regions. Dufner et al.'s diffusion layer is made in such a way that the high and low particle density regions do not vary. Additionally, the hydrophobic and hydrophilic areas are defined with respect to the flow field, such that variance inversely varying the high and low particle density regions could have hydrophilic material adversely affecting gas transfer by blocking the gas flow path. None of the remaining prior art of record, alone or in combination, appear to teach, suggest, or render obvious the invention of claim 14. Therefore the invention of claim 14 is considered patentable over the prior art of record. Since claim 15 is dependent on claim 14, it would be allowable for the same reasons.

Claim 16 teaches a porous diffusion media with relatively high and low particle density regions that vary across a cross a cross section of the porous diffusion media, where the first major face is collectively more hydrophilic than the second face, and the second major face is more hydrophobic than the first major face.

Dufner et al. does teach, suggest, or render obvious the using having a diffusion media where one face is collectively more hydrophilic than the other. In fact, with Dufner et al.'s invention would result in equally hydrophobic and hydrophilic sides. Additionally, Dufner et al.'s diffusion layer is made in such a way that the high and low particle density regions do not vary. The hydrophobic and hydrophilic areas are defined with respect to the flow field, such that variance inversely varying the high and low particle density regions could have hydrophilic material adversely affecting gas transfer by blocking the gas flow path. None of the remaining prior art of record, alone or in combination, appear to teach, suggest, or render obvious the invention of claim 16. Therefore the invention of claim 16 is considered patentable over the prior art of record.

Claim 18 teaches that different high particle density regions vary in density value.

Dufner et al. does teach, suggest, or render obvious changing the density of different high particle density regions across the first and second faces of the diffusion media. None of the remaining prior art of record, alone or in combination, appear to teach, suggest, or render obvious the invention of claim 18. Therefore the invention of claim 18 is considered patentable over the prior art of record. Since claim 19 is dependent on claim 18, it would be allowable for the same reasons.

Claim 37 teaches the fact that the hydrophobic layer is more repellant to water droplets than the relatively high and relatively low particle density regions of the porous diffusion media.

Dufner et al. does not teach, suggest, or render obvious that the hydrophobic layer is more hydrophobic than the relatively high and relatively low particle density regions of the porous diffusion media as defined in claim 37. Furthermore it would not have been obvious to modify Dufner et al.'s porous plate, since it would have adversely affected the desired water transfer of Dufner et al. None of the remaining prior art of record, alone or in combination, appear to teach, suggest, or render obvious the invention of claim 37. Therefore the invention of claim 37 is considered patentable over the prior art of record.

13. Claims 43, 44, 48-53, and 57 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action.

The following is an examiner's statement of reasons for allowance:

Claim 57 teaches a device comprising a porous diffusion media positioned against a catalyst layer, where the diffusion media defines a major planar dimension with first and second major faces substantially parallel to the major planar dimension of the diffusion media. There are water transfer particles in the diffusion media, which are distributed in a manner such that there are high and low density regions of water transfer particles. The high and low particle density regions alternate across the major planar dimension of the porous diffusion media and are distributed between the first and second major faces in such a way that the first major face is collectively more hydrophilic than the second major face, wherein the first and second major faces each comprise of hydrophilic and hydrophobic portions. Additionally, the claim specifies that the diffusion media is positioned against the catalyst layer along the first major face of the diffusion media.

None of the prior art of record, alone or in combination, appear to teach, suggest, or render obvious the invention of claim 57, since none of the prior art teach a diffusion media that is placed against a catalyst with the gradient of water transfer particles to create relatively hydrophobic and hydrophilic faces. Trapp et al. (made of record below) is found to teach a gradient of particles, however, the hydrophobic and hydrophilic nature of the particles and thus the plate [5] is not taught. Additionally, the plate is not used as a diffusion layer, as is specified by claim 57. Therefore the invention of claim 57 is considered patentable over the prior art of record. Since claims 43, 44, and 48-53 are dependent on claim 57, they would be allowable for the same reasons.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

14. Claims 54 is allowed.

The following is an examiner's statement of reasons for allowance:

Claim 54 teaches a device comprising a membrane electrode assembly that is interposed between an anode and a cathode flow field of a fuel cell, where a porous diffusion media with a porous matrix made of carbon paper having a distribution of water transfer particles made of carbon fibers or powders. The water transfer particles are distributed in such a that there are high and low particle density distributed across the major planar dimension between a first and second major face in such a way that the first face is more hydrophilic and the second face is more hydrophobic, where both faces comprising of hydrophobic and hydrophilic portions. The arrangement specifies that the diffusion media is placed with the first face against a catalyst layer and the diffusion second major face is positioned against the flow field. Furthermore, a hydrophobic material comprising of polytetrafluoroethylene (PTFE) is disposed along the second major face of the diffusion media.

None of the prior art of record, alone or in combination, appear to teach, suggest, or render obvious the invention of claim 54, since none of the prior art teach a diffusion media that is placed against a catalyst with the gradient of water transfer particles to create relatively hydrophobic and hydrophilic faces. Trapp et al. (made of record below) is found to teach a gradient of particles, however, the hydrophobic and hydrophilic nature of the particles and thus the plate [5] is not taught. Additionally, the plate is not used as a diffusion layer, as is specified by claim 54. Therefore the invention of claim 54 is considered patentable over the prior art of record.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

## ***Conclusion***

The prior art made of record (WO 01/04980, Trapp et al.) and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugenia Wang whose telephone number is 571-272-4942. The examiner can normally be reached on 8 - 4:30 Mon. - Fri., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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